MOBILE GAME-BASED LEARNING (mGBL) ENGINEERING MODEL

A thesis submitted to the
Dean of Awang Had Salleh Graduate School of Arts and Sciences
in full fulfillment of the requirement for the degree of Doctor of Philosophy
Universiti Utara Malaysia

by
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2011

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DECLARATION

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ABSTRACT

Mobile game-based learning (mGBL) is a game played on any handheld devices such as mobile phones. It is among the most recent growing research areas whereby its main aim is to use game play to enhance motivation in learning, engage in knowledge acquisition, and improve the effectiveness of learning activities through mobile environment. To fully utilize the potential of mGBL, researchers suggest looking at the most important part, which is the development methodology of mGBL. In relation to this, various game development methodologies have been introduced for different types of game genres and platforms. These methodologies propose different numbers of steps and activities; some focusing only on the learning design; some concentrating on the mobile technologies; and others on the complete life cycle. Although many game methodologies have been introduced, studies show that customized phases and steps to develop games for learning in mobile environment are substantially required. Therefore, the study discussed in this thesis addresses this gap by proposing an mGBL Engineering Model based on a number of games and learning theoretical and developmental foundations. In particular, the study identified the key steps of development methodology to be considered in developing mGBL applications which consist of phases, components, steps, and deliverables. In accomplishing this aim, a design science research methodology was adopted, comprising of five phases; (i) awareness of problem, (ii) suggestion, (iii) development, (iv) evaluation, and (v) conclusion. Subsequently, eight mGBL evaluation dimensions were put forward: visibility, complexity, compatibility, flexibility, clarity, effectiveness, manageability, and evolutionary. Model evaluation was conducted in three phases, namely; expert review, prototype development with heuristics evaluation, and experimental study. Generally, the proposed mGBL Engineering Model was well accepted by the experts contacted in this study. The model was also employed by a game company while developing an mGBL prototype. Here, the findings have implied that the model is useful to follow and it provides an easy guideline for fellow developers. In the experimental study phase, four learning or game methodologies; Analysis-Design-Development-Implementation-Evaluation, Input-Process-Output, Game Life Cycle, and mGBL Engineering Model; were studied and compared by 70 respondents. The findings have indicated that the proposed mGBL Engineering Model scored mean above 7.0 (out of 10) of all dimensions compared to the other three models (scored less than 7.0). The ANOVA results show that there are significant differences between all groups in six dimensions except complexity and compatibility. Although complexity and compatibility dimensions are not significantly different, the scores for the mGBL Engineering Model are higher than the other three models. All these results have demonstrated that the proposed mGBL Engineering Model exhibits useful development indicators for mGBL applications and is indeed a theoretical and practical contribution of the study. In addition, the other significant contributions are the eight evaluation dimensions together with the validated instrument. Furthermore, the artefact produced, which is the mGBL prototype is also a functional contribution.

ABSTRAK

Permainan pembelajaran mudah alih (*mGBL*) merupakan permainan yang dimainkan pada peralatan mudah alih seperti telefon mudah alih. Bidang ini antara bidang penyelidikan yang sedang berkembang di mana tujuan utamanya adalah menjadikan corak permainan sebagai jalan untuk meningkatkan motivasi dalam pembelajaran, penglibatan dalam mendapatkan pengetahuan, dan meningkatkan keberkesanan aktiviti pembelajaran melalui persekitaran mudah alih. Untuk mempertingkatkan potensi mGBL, para penyelidik mencadangkan untuk menumpukan aspek yang paling penting iaitu metodologi pembangunan mGBL. Oleh itu, banyak metodologi pembangunan permainan telah diperkenalkan dengan pelbagai jenis permainan dan platfom. Metodologi tersebut mencadangkan pelbagai langkah dan aktiviti, antaranya ada yang lebih menekankan reka bentuk pembelajaran, ada pula teknologi mudah alih, dan ada juga kepada kitaran hayat. Walaupun banyak metodologi diperkenalkan, kajian menunjukkan bahawa fasa dan langkah yang boleh disesuaikan dalam pembangunan permainan untuk pembelajaran di persekitaran mudah alih adalah sangat diperlukan. Oleh itu, kajian yang dibincangkan dalam tesis ini mencadangkan penyelesaian melalui Model Kejuruteraan mGBL yang berpandukan kepada teori dan asas pembangunan permainan dan pembelajaran. Secara khususnya, kajian ini mencari langkah utama dalam metodologi pembangunan mGBL iaitu fasa, komponen, langkah, dan hasilnya. Bagi mencapai tujuan tersebut, metodologi kajian sains rekabentuk digunakan yang mempunyai lima fasa iaitu (i) kenal pasti masalah, (ii) cadangan, (iii) pembangunan, (iv) penilaian, dan (v) kesimpulan. Selain itu, lapan dimensi penilaian mGBL diketengahkan: keterlihatan, kerumitan, kesesuaian, kelenturan, kejelasan, keberkesanan, pengurusan, dan evolusi. Penilaian model dilakukan dalam tiga cara iaitu; penilaian pakar, pembangunan prototaip dengan pengujian heuristik, dan kajian eksperimen. Umumnya, model yang dicadangkan ini diterima baik oleh pakar-pakar yang terlibat dalam kajian ini. Model ini juga digunakan oleh sebuah syarikat permainan dengan membangunkan prototaip mGBL. Di sini, hasil dapatan menunjukkan bahawa model tersebut berguna untuk diikuti dan memberikan garis panduan kepada para pembangun. Dalam fasa kajian eksperimen, empat metodologi permainan atau pembelajaran; *Analysis-Design-Development-Implementation-Evaluation, Input-Process-Output, Game Life Cycle* dan Model Kejuruteraan mGBL, dikaji dan dibandingkan oleh 70 responden. Hasil dapatan menunjukkan bahawa model cadangan mendapat skor min melebihi 7.0 (dari 10) untuk semua dimensi jika dibandingkan dengan tiga model tersebut (skor kurang dari 7.0). Keputusan ANOVA menunjukkan terdapat perbezaan signifikan antara enam dimensi penilaian kecuali kerumitan dan kesesuaian. Walaupun dimensi kerumitan dan kesesuaian tidak berbeza secara signifikan, skor diperolehi model cadangan ini lebih tinggi. Keputusan ini menunjukkan bahawa model cadangan tersebut boleh diaplikasikan dalam pembangunan mGBL yang menjadi sumbangan secara teori dan praktikal dalam kajian ini. Selain itu, sumbangan lain ialah lapan dimensi penilaian melalui instrumen yang telah ditentu sah. Artifak yang dihasilkan, yang merupakan prototaip mGBL juga merupakan satu lagi sumbangan fungsian.

ACKNOWLEDGEMENT

Alhamdulillah, first and foremost all praise and thanks be to Allah s.w.t for giving me the opportunity to complete this thesis. I would like to express my sincere gratitude to Prof. Dr. Norshuhada Shiratuddin, my supervisor, for her insightful mentoring, advice, and support during this thesis process. Not forgetting the Malaysian government and Universiti Utara Malaysia for sponsoring this study.

I would also like to thank my colleagues and friends at Information Technology and Multimedia programmes, Universiti Utara Malaysia for their encouragement and support throughout this journey.

Special thanks go to Aspati groups, who gracefully agreed to participate as the developer of mGBL following the proposed model.

Finally and most importantly, I deeply thank my loving parents Hj. Zaibon & Hjh. Ainun, parents in law, lovely wife Hidayati, dearly daughter Syafi, and families for all their support and patience in these past several years.

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LIST OF ABBREVIATIONS

ADDIE	Analysis, Design, Development, Implementation and Evaluation
AI	Appreciative Inquiry
ANOVA	Analysis of Variance
ARCS	Attention, Relevance, Confidence, and Satisfaction
CBT	Computer Based Training
CD	Compact Disk
GBL	Game-Based Learning
GD	Game Design
GLC	Game Life Cycle
GPS	Global Positioning System
ICT	Information and Communication Technology
ID	Instructional Design
IGDA	International Game Developer Association
IPO	Input-Process-Output
ITU	International Telecommunication Union
MCMC	Malaysian Communications and Multimedia Commission
MMORGP	Multiplayer Online Role-Playing Game
mGame	Mobile Game
mGBL	Mobile Game-Based Learning
MMS	Multimedia Messaging Service
PBL	Problem Based Learning
PDA	Personal Digital Assistant
SMS	Short Messaging System
UUM	Universiti Utara Malaysia
VCD	Video Compact Disk

LIST OF PUBLICATIONS

Journals:

- Norshuhada Shiratuddin & **Syamsul Bahrin Zaibon**. (2010). Mobile Games Based Learning (mGBL) with Local Content and Appealing Characters, *Int. Journal of Mobile Learning and Organization*, 4(1), pp. 55-82. USA.
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LIST OF AWARDS AND RECOGNITIONS

- Award: **Gold Medal** at the Seoul International Invention Fair 2009 (SIIF2009), Korea.
    - Project Title: *1M'sia Mobile Game*.
    - Project Members: Norshuhada Shiratuddin & **Syamsul Bahrin Zaibon**.
- Award: **Gold Medal** at the International Exposition of Research and Invention of Institutions of Higher Learning 2009 (PECIPTA2009), Kuala Lumpur.
    - Project Title: *1Malaysia through Local Content*.
    - Project Members: Norshuhada Shiratuddin & **Syamsul Bahrin Zaibon**.
- Award: **Bronze Medal** at the Malaysian Technology Expo 2009 (MTE2009), Kuala Lumpur.
    - Project Title: *MY Road Traffic Signs mGame*.
    - Project Members: Norshuhada Shiratuddin, **Syamsul Bahrin Zaibon** & Ayman Srour.

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CHAPTER 1

Background of Study

1.1 Introduction

This introductory chapter deliberates on the motivation aspects of the study; the advances of mobile learning (m-learning), the statement of the problem; objectives and significances of the study; and lastly, definition of the terms that are used throughout the study.

1.2 Research Motivations

A few aspects have been brought towards the proposed title of this study. Therefore, this section summarizes some aspects which motivate the study to be conducted.

1.2.1 Current State of Mobile Phone Subscriptions in Malaysia

The ownership of mobile phone is exponentially increasing all around the world. The International Telecommunication Union (ITU) Telecommunication/ Information Technology and Communication (ICT) Indicators Report (ITU, 2008) found indication that ICTs, broadband, and mobile phone uptake advance growth and development in Asia Pacific region. This is due to the fact that mobile technology is naturally portable, flexible to anywhere, possible to connect users to variety of information sources and enable communication everywhere (Smith et al., 1999; Naismith et al.,

The contents of the thesis is for internal user only

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